INTRODUCTION

Single tooth as well as full mouth rehabilitation using implant-supported prosthesis has currently become a widely used treatment modality in dental practice. Implant-supported restoration aids in functional and esthetic rehabilitation. To achieve a good functional and esthetic result with implant restoration, it is important to consider the biological principles of soft and hard tissues around an implant. Adequate crestal bone level is considered as an important clinical determinant for the success of implants. Marginal bone loss not only results in implant failure but also affects the esthetics due to changes in the gingival contour, thereby resulting in the loss of interdental papilla. The type and size of implant is also said to influence the outcome of the treatment. The notion of crestal bone changes after implant placement and prosthetic reconstruction has been reported earlier. Many factors have been reported to cause this bone loss, the most common being overload, micropat at the implant abutment interface, polished implant neck as well as other factors like trauma during the surgical procedure, inflammation/infection and implant exposure during soft tissue healing etc. which are still being investigated worldwide.

Evaluation by radiograph is considered as a method to measure crestal bone loss to facilitate a successful implant treatment. A vertical marginal peri-implant bone loss of 1–1.5 mm during the first year of function followed by a yearly bone loss of 0.1–0.2 mm has been reported in a number of clinical studies. However, when one-piece implants were utilized, minimal marginal bone loss has occurred. The criteria proposed by Albecksson et al are widely cited and used for the evaluation of the success of dental implants, including the one that vertical bone loss should be less than 0.2 mm annually following the first year of function of an implant. A study by Mumcu et al reported no significant relation between crestal bone loss and implant dimension might be one of the factors influencing the long term success of the implant.

Key words: Crestal bone loss, dental implants, causative factors

ABSTRACT

The aim of this study was to evaluate the alveolar crestal bone loss around dental implants with various diameters. A total of 120 patients (70 male and 50 female) with 150 single Nobel Replace® Select Tapered of different width were included in this study. The implants of size 3.5mmX10mm, 4.3mmX10mm, 5mmX10mm were used in this study. For each implant, radiographic measurements of the marginal bone height and its change over time were made. Intraoral radiographic examinations of all implants were performed at baseline, using paralleling technique and was compared to those taken at various subsequent post-placement times at the end of 1st year, 2nd year and 3rd year follow-ups to evaluate crestal bone level changes. The regular neck and wide neck implants showed relatively higher crestal bone loss compared to the narrow neck implants. All the three groups showed a progressive increase in bone loss from first year to the 3rd year after implant placement. It can be concluded that implant dimension might be one of the factors influencing the long term success of the implant.

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length or diameter of implants. There is no consensus on the effect of variables like age, gender, and implant size on marginal bone levels around the implants. Long-term clinical and radiographic evaluation is required to evaluate the effect of implant size on crestal bone level changes. Hence the present study is undertaken to evaluate the crestal bone loss around dental implants with various diameter.

**METHODOLOGY**

A total of 120 patients (70 male and 50 female) with 150 single Nobel Replace® Select Tapered implants of different widths were included in this study. The implant varied in diameters with a length of 10 mm was used (3.5 mm × 10 mm, 4.3 mm × 10 mm, 5 mm × 10 mm). Patients attending the private dental clinic were included in the study. The criteria for inclusion in the study consisted of a well-healed bone site for the insertion of an implant. Patients treated with osseous grafts or other augmentation procedures as well as smokers were excluded from this study.

A one-stage surgical technique was used for the installation of implants. The healing period for all implants was 3 months. All implant placements was done by the same periodontist. Intraoral radiographic examinations of all implants were performed at baseline using a paralleling technique and were compared with those taken at various subsequent post-placement times in the first year, second year, and third year follow-ups to evaluate crestal bone level changes.

The digital radiographs were measured using image analysis software (Scion Image, Scion Corp., Fredrick, Maryland, USA). The radiographs were measured by one dentists trained in the use of the analysis program. Marginal bone levels were measured from the top of the implant cylinder to the first bone to implant contact. The geometry of the implant was used to assess the distortion of the images. Mesial and distal measurements were made in millimeters, and averaged. Measurements were transferred to data sheets and analyzed statistically. For each implant, a radiographic measurement of the marginal bone height was made. The measurements were made on the mesial and distal surface of each implant and the mean was taken. All measurements were repeated three times. The measurements were tabulated and analysed statistically using graphpad Instat software.

**STATISTICAL ANALYSIS**

Alveolar crestal bone levels were compared at different time intervals (at one, two and three year) to the baseline radiographs. ANOVA (Instat Graph Pad Software) was used for statistical analyses. Statistical analyses were used to identify significant changes from the baseline crestal bone levels. The data were further divided to compare these changes for narrow (3.5mm), regular (4.3mm) and wide (5mm) platform implants.

**RESULTS**

The mean age of the study participants was 41 ±6.2 years. The mean crestal bone loss for the Wide neck dental implant was (1.43±0.43, 1.69±0.41, 2.03±0.44) at the end of 1st, 2nd and 3rd year respectively (Table 1 and Fig 1). The mean crestal bone loss for the Regular neck dental implant was (1.33±0.32, 1.66±0.41, 2.01±0.47) at the end of 1st, 2nd and 3rd year respectively (Table 1 and Figure 1). The mean crestal bone loss for the Narrow neck dental implant was (1.20±0.30, 1.6±0.34, 1.91±0.46) at the end of 1st, 2nd and 3rd year respectively (Table 1 and Fig 1). All the three groups of implant showed increasing crestal bone loss at the end of the 1st, 2nd, and 3rd year follow ups. The narrow neck implant showed minimum crestal bone loss at all the three time intervals compared to Regular neck and Wide neck implants (p>0.05).

**DISCUSSION**

Many studies have evaluated the crestal bone changes around a one stage dental implants after placement and for a long period of time19,25-27. In these studies it was found that the bone loss ranges from 0.75 to 1 mm at the end of the first year after placement and thereafter decreased annually. Also it was reported in other studies, a crestal bone loss within the range of 1 to 1.5 mm during the first year9,28. Most studies demonstrate a minor bone loss around implants in general with a steady state of loss after a couple of years in function18,29,30. Lately, however, studies have been published demonstrating continuous bone loss and peri-implantitis in higher frequencies than earlier demon-

**TABLE 1: THE MEAN CRESTAL BONE LOSS IN THE THREE TYPES OF IMPLANT USED**

<table>
<thead>
<tr>
<th>Type of Implant</th>
<th>Year 1 (mean ± SD)</th>
<th>Crestal Bone loss Year 2 (mean ± SD)</th>
<th>Year 3 (mean ± SD)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow Neck</td>
<td>1.20 ± 0.30</td>
<td>1.60 ± 0.34</td>
<td>1.91±0.46</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Regular Neck</td>
<td>1.33 ± 0.32</td>
<td>1.66 ± 0.41</td>
<td>2.01±0.47</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Wide Neck</td>
<td>1.43 ± 0.43</td>
<td>1.69 ± 0.41</td>
<td>2.03 ± 0.44</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>
Radiologic evaluation of the marginal bone loss around dental implants

The results of the present study was in agreement with these previous studies and it was found that the crestal bone loss ranges from 0.9 to 1.86 mm during the first year and decreased dramatically in the second and third year after placement.

Many factors have been reported to cause crestal bone loss around dental implants after placement; the most common being overload, microgap at the implant abutment interface, polished implant neck as well as other factors like trauma during the surgical procedure, inflammation/infection and implant exposure during soft tissue healing. In the present study the crestal bone loss in relation to the size of the dental implant was evaluated. All implants were placed at the same level of the crestal bone and have the same length but different diameter (NP 3.5 X 10mm, RP 4.3 X 10mm, WP 5 X 10mm). Taking the size of implant into consideration, the mean crestal bone loss around WP 5 X 10mm implant was the highest at the end of the first year (1.43±0.43 mm) in comparison to RP 4.3 X 10mm (1.33±0.32mm) and NP 3.5 X 10mm (1.20±0.30mm). This pattern of crestal bone loss was maintained at the end of the 2nd and 3rd year of evaluation. The differences in the crestal bone level at the end of the 2nd and 3rd year between different implant diameters were not significant as it was at the end of the first year. The reason for this pattern of bone loss in the present study is not well understood. Many studies have been conducted to understand the biomechanical behavior around dental implants and to evaluate the effect of diameter and length on stress distribution on the alveolar crest around loading implants. In that study, it was found that increasing the diameter and length of the implant decreased the stress and strain on the alveolar crest and the diameter had a more significant effect than length to relieve the crestal stress and strain concentration. In the present study increasing the diameter may be related to the decrease in the difference in the crestal bone loss at the end of 2nd and 3rd year due to more distributed stress and strain around implants after loading. In contrast, the increase in diameter caused an increased stress and strain to the surrounding crestal bone around the implants at the initial time of placement and that lead to more crestal bone loss at the end of the first year with wide neck implants in comparison to narrow neck implants.

To achieve a good functional and esthetic result with implant restoration, it is important to consider the biological principles of soft and hard tissue adaptation around an implant. Accordingly, it is apparent that the ability to predict the degree of the crestal bone loss after implant placement is crucial to achieve the esthetic and functional outcome of the final restoration.
CONCLUSION

The results of the present study show that radiographic crestal bone loss around wider neck dental implants was higher than that around regular and narrow neck dental implants. Understanding the biomechanical behavior of the crestal bone around the implants is important to predict the degree of the crestal bone loss and to avoid functional and esthetic dysfunction.

REFERENCES